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ABSTRACT

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Methods: Data came from the National Longitudinal Study of Adolescent to Adult Health. At Wave IV, young adults aged mostly 24 to 32 years reported their SSS, oSES, and a range of covariates of both SES and elevated inflammation. Trained fieldworkers assessed medication use, body mass index, and waist circumference, and also collected bloodspots from which high-sensitivity C-reactive protein (hs-CRP) was assayed. The sample size for the present analyses was n = 13,236.

Results: Descriptive and bivariate analyses revealed a graded association between SSS and hs-CRP (b = −0.072, standard error [SE] = 0.011, p < .001): as SSS declined, mean levels of hs-CRP increased. When oSES indicators were taken into account, this association was no longer significant in women (b = −0.013, SE = 0.019, p = .514). In men, a small but significant SSS–hs-CRP association remained after adjusting for oSES indicators and additional potential confounders of this association in the final models (b = −0.034, SE = 0.011 p = .003; p < .001 for the sex by SSS interaction).

Conclusions: SSS is independently associated with elevated inflammation in young adults. The associations were stronger in men than in women. These data suggest that subjective, global assessments of social rank might play a role in developing adverse health outcomes.

Key words: subjective social status, inflammation, sex differences, young adulthood, cardiovascular risk, add health.

INTRODUCTION

Objective socioeconomic status (oSES)—including years of education, occupational status, and income—is a highly robust psychosocial predictor of cardiovascular disease and mortality risk (1–6). In any layer of oSES, however, people vary considerably in their subjective social status (SSS), that is, their actual perceptions of their position in the social hierarchy. Whereas oSES focuses on objective indices only, SSS represents a global, complex summary of everyday experiences of social rank (e.g., Ref. (7)). SSS ratings are informed not only by oSES indicators but also by "softer" aspects of status. These include cognitive and emotional appraisals of social standing (e.g., status among peers, neighbors, and coworkers; perceived rejection; and stigma), access to privileges and resources, and projected future standing (8–12). Unsurprisingly, correlations between oSES and SSS rarely exceed the r = 0.30-0.50 range (e.g., Refs. (3,7,13,14)).

Not all indicators of SES play an equal role in informing the body's response to its social environment. Notably, subjective assessments of rank may hold a key or independent role in SES-physiology associations (e.g., Refs. (9,14)). In animal models (e.g., Ref. (15)), social demotion/defeat induces systemic inflammation (e.g., Refs. (16,17)). In humans, threats to social status and low social dominance rankings are associated with inabilities in maintaining

Add Health = National Longitudinal Study of Adolescent to Adult Health, **hs-CRP** = high-sensitivity C-reactive protein, **oSES** = objective socioeconomic status, **SSS** = subjective social status

SDC Supplemental Content

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homeostatic hypothalamic-pituitary-adrenal axis and immune activation (7,9,18–24). Indeed, in middle-aged (e.g., Ref. (14)) and in some studies, older adults (e.g., Ref. (10)), lower SSS is associated with higher inflammation when adjusting for oSES indicators. Thus, subjective assessments of social rank independently predict cardiovascular disease and mortality risk (e.g., Refs. (10,12)).

SSS and Inflammation During Young Adulthood

No nationally based study has examined associations between subjective social rank and inflammation in young adulthood. However, this developmental period is distinctive, in part because social status is highly in flux *and* of heightened salience (e.g., Ref. (25)). Many educational and career milestones of the young adult years involve social rankings, including admission to postsecondary education and vocational training, securing jobs, and developing career trajectories (25). During this developmental period, measures of oSES (e.g., income) may not fully capture actual and projected access to resources. For example, many young people with high earnings potential have low incomes; a similar observation could be made for occupational prestige. SSS during young adulthood could be particularly informative for health-related research because it draws on past, current, and expected objective and subjective experiences of social rank.

When testing SSS–inflammatory marker associations in young adults, examining sex differences is important. Levels and correlates of high-sensitivity C-reactive protein (hs-CRP) during this developmental period are partially sex differentiated (26–28). Young women's hs-CRP levels are almost twice as high compared with those of men. Women face a multitude of potentially proinflammatory influences, ranging from actual chronic disease processes to use of oral contraceptives and hormonal/metabolic shifts related to pregnancy, childbirth, and breast-feeding (26,28). Testing sex differences in SSS-inflammation associations during young adulthood is also important because social rankings—including potential for resource and earnings acquisition—are still a key element of success in securing a mate for men in US society (e.g., Refs. (29,30)). Indeed, men's perceptions of social dominance seem to be more closely linked with biomarkers of social dominance such as higher testosterone (31) that are also closely linked with lower systemic inflammation (26). In contrast, associations between social dominance and such biomarkers have not consistently been documented in women (31).

The present study fills a notable gap in research by using a nationally representative US sample of young adults to test associations between SSS and hs-CRP—a marker of systemic inflammation and risk for future morbidity and mortality (32–34). The study also tests whether SSS-inflammation associations are stronger in young adult men than in young adult women.

METHODS

Sample and Procedures

Data came from Waves I and IV of the National Longitudinal Study of Adolescent to Adult Health (Add Health; see Ref. (35)). Wave I of Add Health is a nationally representative sample of adolescents enrolled in middle or high school in the United States in 1994. The National Quality Education Database, which lists all US high schools, provided the sampling frame. Eighty high schools were randomly selected out of all high schools with an 11th grade and at least 30 students enrolled. These 80 high schools were paired with middle schools that fed into their student body. Together, 145 schools hosted an in-school survey, yielding 90,118 student respondents in grades 7 to 12 in 1994.

Approximately 200 students from each school were randomly selected for in-depth in-home interviews, resulting in $n = 20{,}745$ (Wave I). The only variables from Wave I used in the present analyses are participants' race/ethnicity and parental education. Wave IV was collected when respondents were almost all between ages 24 and 32 years (14 years after Wave I). Of the eligible respondents from Wave I, 93% were relocated, 80% were reinterviewed, resulting in 15,701 in-home interviews. Wave IV blood samples were obtained at the end of each interview, as described in the Add Health documentation of biomarker collection procedures (36). Dried blood spots were mailed to and assayed at the University of Washington Department of Laboratory Medicine. Add Health participants provided written informed consent for participation in all aspects of Add Health in accordance with the University of North Carolina School of Public Health Institutional Review Board guidelines.

Measures

High-Sensitivity C-Reactive Protein

In-depth documentation of the Add Health hs-CRP assay and quality control is available online (36). Briefly, a sandwich enzyme-linked immunosorbent assay method was adapted from a previously published method (37). Values from dried blood spots and paired plasma samples were highly correlated ($r = 0.98$) in a cross-validation study. Intra-assay variation was 8.1% and interassay variation was 11%. We used a continuous, log-transformed variable of hs-CRP that included the full range of values. In follow-up sensitivity analyses, we tested all models using a log-transformed continuous hs-CRP < 10 mg/l as the outcome variable. We used this strategy because the percentage of cases with hs-CRP ≥ 10 mg/l exceeds 10% in the Add Health study, and hs-CRP ≥ 10 mg/l is associated with many indicators of chronic disease risk in this data set (28).

Subjective Social Status

SSS was measured using a 10-rung self-anchoring scale (e.g., Ref. (7)). Respondents were asked the following question to gauge their position on this ladder: "Think of this ladder as representing where people stand in the United States. At the top of the ladder (step 10) are the people who have the most money and education, and the most respected jobs. At the bottom of the ladder (step 1) are the people who have the least money and education, and the least respected jobs or no job. Where would you place yourself on this ladder? Pick the number for the step that shows where you think you stand at this time in your life, relative to other people in the United States." Higher values indicated higher status and lower values indicated lower status.

Objective Socioeconomic Status

Participants' educational attainment (Wave IV) was assessed on an 11-point scale (1 = *less than 8th grade* to 11 = *doctoral degree*). The mean

value, M = 5.59, falls between completing vocational training after high school and completing some college. *Participants' household income* (Wave IV) was measured as total income from all sources before taxes and deductions. Most respondents reported their household income in dollars. A few preferred to report a range; the midpoints of the indicated ranges were used for these respondents. Household income was logged for this analysis, which reduced the likelihood of a nonlinear relationship between income and hs-CRP levels. *Participants' occupational prestige* (Wave IV) was measured using the socioeconomic index of occupations created by Hauser and Warren (38). The index is a weighted average of occupational education and occupational earnings (for a full description for how the index is created, see Ref. (38)). The mean occupational prestige score is M = 38.85 (range, 9.14–99.01). Finally, *parental education* (Wave I) was assessed from a parent/caregiver who reported on their own and the other residential parent's (when applicable) education. The highest level of education completed by either parent was coded, ranging from 0 = *≤8th grade* to 5 = *professional training beyond a 4-year college/university degree*. Child reports of parental education were substituted when parental reports were not available.

Demographics

Dummy variables coded participants' sex (1 = *female*) and racial/ethnic groups: white, Hispanic, black, Asian, and other. Participants who indicated being Hispanic were coded into this category regardless of whether they indicated any other race/ethnic category.

Illness and Medication Use

Illness and medication use were assessed with checklists of recent and chronic health conditions, as is common in this type of field-based, epidemiological research. For self-reported diagnoses, participants were asked whether a doctor, nurse, or other health care provider had ever told them that they had a given condition. The *subclinical symptoms* scale counted whether participants reported having had a fever, night sweats, nausea or vomiting or diarrhea, blood in stool or urine, frequent urination, and skin rash or abscess in the past two weeks. The *infectious/inflammatory diseases* scale counted lifetime diagnosis of asthma or chronic bronchitis or emphysema, lifetime diagnosis of hepatitis C, and also gum disease, active infection, injury, acute illness, surgery, and active seasonal allergies in the past 4 weeks. *Other illness* counted self-reported diagnoses of cancer or lymphoma or leukemia, high blood cholesterol or triglycerides or lipids, high blood pressure or hypertension, high blood sugar or diabetes, heart disease, migraine headaches, epilepsy or another seizure disorder, and HIV/AIDS. Counts greater than 3 for the illness variables were collapsed to a value of "3." The first two measures were constructed in accordance with the Add Health documentation (36). The other illness variable captured the remaining health conditions that were assessed.

Medication use was primarily recorded by interviewers from medications/containers provided by participants. A minority of participants (22%) recalled their medication use. The medication use variable indicated whether respondents were taking a) nonsteroidal anti-inflammatory drug/salicylate medication, including in the past 24 hours; b) cyclooxygenase-2 inhibitor; c) inhaled corticosteroid; d) corticotropin/glucocorticoid; e) antirheumatic/antipsoriatic; or f) immunosuppressive medications in the past 4 weeks. This indicator was constructed in accordance with the Add Health documentation (36).

Health Behaviors

Physical activity was assessed with seven items that asked how many times participants had engaged in a variety of sports in the past 7 days (e.g., running, bicycling, weightlifting, soccer, football, and walking). Physical activity was coded as the maximum number of times that a participant had engaged in physical activities across these items with 0 = *not at all* to *3 ≥ 3 time or more in the past 7 days*. *Alcohol use* was assessed as the extent of drinking in the past year. Possible responses included 0 = *never*, 1 = *1 or 2 days in the past 12 months*, 2 = *once a month or less*, 3 = *2 or 3 days a month*, 4 = *1 or 2 days a week*, 5 = *3 to 5 days a week*, and 6 = *almost every day.* The dichotomous *past smoking* variable indicated whether the participant had ever smoked. The dichotomous *current smoking* variable indicated whether the participant had smoked at least 1 cigarette/d in the past 30 days.

Adiposity-Related Variables

Adiposity-related variables were assessed by trained field interviewers. *Body mass index* (BMI) was calculated as weight (kg)/height (m^2). Because associations between BMI and hs-CRP have been reported to differ by sex (e.g., Ref. (26)), a BMI by hs-CRP interaction was included. A squared BMI term was created to allow for effects of extreme obesity. BMI is typically a strong correlate of CRP and, thus, typically adjusted for in analyses testing unique associations with CRP (39). *Waist circumference*—an additional and perhaps better indicator of health-related adiposity—was measured in centimeters.

Variables Used in Sensitivity Analyses

Several additional variables that could be associated with both SSS and hs-CRP were adjusted for in sensitivity analyses. Young adults reported whether they were *married* or *cohabiting*. *Depressive symptoms* were measured with four indicators from the Center for Epidemiologic Studies Depression Scale items with adequate Cronbach α values, as described by Perreira et al. (40). Items included "could not shake off the blues," "felt depressed," "felt happy" (reverse coded), and "felt sad" in the past week. *Neuroticism* was assessed using Mini-International Personality Item Pool items and consisted of the simple sum with appropriate reverse coding, with Cronbach $\alpha = .62$ in the Add Health study (41,42). A dichotomous *insomnia* variable indicated whether participants reported difficulties either falling asleep or staying asleep on a daily or almost-every-day basis. Self-rated health (SRH) was assessed by asking "In general, how is your health." Possible responses were 5 = *excellent*, 4 = *very good*, 3 = *good*, 2 = *fair*, and 1 = *poor*. An SRH by sex interaction was also tested considering that previous work using this data set had shown that SRH was associated with hs-CRP in young adult men but not women in fully adjusted models (43). Women reported whether they were *currently pregnant* or taking *oral contraceptives*.

Analytic Strategy

Linear regression models predicted logged hs-CRP as the outcome. *Model 0* tested bivariate associations between all study variables and hs-CRP. We then estimated six nested regression models predicting hs-CRP with SSS, assessing whether SSS was associated with CRP independent of oSES measures and common covariates of both SES and CRP (44). *Model 1* entered the main effect of sex, and the interaction between sex and SSS, which tested whether SSS-CRP associations differed in men and women. *Model 2* added oSES indicators. *Model 3* added race/ethnicity indicators. The next few models added possible confounds of the SSS-CRP association: *Model 4* added illness and medication use indicators, *Model 5* added health behaviors, and *Model 6* added obesity-related variables. All models were weighted using Add Health survey weights to adjust for unequal probabilities of selection into the initial sample and attrition between Waves I and IV. Sensitivity analyses tested whether the pattern of significant findings regarding SSS from Model 6 would remain the same when adjusting for additional variables, excluding cases with hs-CRP ≥ 10 mg/l or acute illness and testing interactions among SSS, race, and sex, and also oSES and sex.

The analysis sample consisted of cases with valid sample weights (n = 14,800), nonmissing for hs-CRP (n = 13,247), and nonmissing for sex and race (n = 13,236). Missing values on the remaining predictors/covariates ranged from none (many of the Wave IV variables) to n = 148 on BMI to n = 205 on parental educational attainment to n = 839 on young adults' own income. We constructed five complete data

sets via multiple imputation with chained equations to address the missing data. The substantive pattern of results remained unchanged when increasing the number of imputed data sets to $n = 20$ (45) or when using listwise deletion.

RESULTS

Descriptive Statistics

Table 1 shows the percent of participants at each level of SSS (M [standard deviation] = 5.02 [1.72]), demonstrating that SSS was essentially normally distributed for women and men. Mean SSS did not differ by sex. Descriptive statistics of CRP and study covariates can be found in Table S1, Supplemental Digital Content 1, http://links.lww.com/PSYMED/A271.

SSS–oSES indicator correlations were $r = 0.33$ ($p < .001$) for educational attainment, $r = 0.33$ ($p < .001$) for logged household income, $r = 0.16$ ($p < .001$) for occupational prestige, and $r = 0.18$ ($p < .001$) for parental education.

Bivariate Associations

Table 2 (Model 0) shows that a) lower SSS ratings were associated with higher levels of hs-CRP, b) female sex was associated with higher hs-CRP, and c) there were bivariate associations between all other covariates and hs-CRP.

Adjusted Models

In Model 1 ("SSS by sex interaction"; see Table 2), a significant SSS by sex interaction emerged. Specifically, the SSS–hs-CRP association was stronger in men ($b = -0.093$, $p < .001$) than in women ($b = -0.046$, $p < .001$). Figure 1 shows bivariate associations between SSS and the continuous logCRP variable in the overall sample, men, and women.

In Model 2 ("objective SES"), higher participant and parental educational attainment were both independently associated with hs-CRP. Including these coefficients did not, however, account for the SSS by sex interaction. In follow-up analyses, we standardized the regression coefficients for SSS, participant education, and parental education in men. Standardized β values were at −0.101, −0.073, and −0.059, respectively. Thus, SSS was uniquely associated with hs-CRP at a level similar (or slightly higher) to that of oSES indicators. In Model 3 ("race/ethnicity"), being Hispanic was associated with higher levels of hs-CRP and being Asian with lower levels. In Model 4 ("illness/medication use"), subclinical symptoms, other illness, and medication use were all associated with higher hs-CRP. In Model 5 ("health behaviors"), more physical activity and more alcohol use were associated with lower levels of hs-CRP. Finally, in Model 6 ("obesity"), all indicators of health-related adiposity (BMI, BMI^2, and waist circumference) were associated with hs-CRP, as was the BMI by sex interaction. As reported in another study, BMI was more strongly associated with hs-CRP in women than in men in this sample (43).

Importantly, once these variables were entered into the model, the SSS by sex interaction did not diminish in size. In fact, it increased in size with the adjustment for health-related adiposity in Model 6. Tables S2 and S3 (Supplemental Digital Content 1, http://links.lww.com/PSYMED/A271) show results separately for men and women and further illustrate that lower SSS was associated with higher CRP in men in all models. In contrast, in women, SSS was associated with hs-CRP in bivariate models only. Once measures of oSES—especially parental and participant education—had been taken into account, SSS was no longer significantly associated with CRP in women.

Sensitivity analyses were conducted to test the robustness of the sex by SSS interaction observed in the final model. This interaction remained significant when a) deleting cases with hs-CRP ≥ 10 mg/l (Table S4, Supplemental Digital Content 1, http://links.lww.com/PSYMED/A271), b) deleting cases with at least one acute condition (e.g., fever, night sweats, vomiting, etc), c) deleting cases with at least two acute conditions, d) adjusting for variables that

TABLE 1. Weighted Percentage of Young Adults in Each Category of Subjective Social Status

Subjective Social Status	Overall ($n = 13{,}236$), Weighted %	Male ($n = 6055$), Weighted %	Female ($n = 7181$), Weighted %
[1] ("bottom of the ladder")	2.16	1.87	2.41
[2]	4.36	4.53	4.22
[3]	12.29	12.78	11.88
[4]	17.84	17.46	18.16
[5]	27.30	26.08	28.32
[6]	16.82	17.42	16.31
[7]	12.19	12.54	11.89
[8]	4.77	4.91	4.65
[9]	1.20	1.19	1.21
[10] ("people with the most money, education, and respected jobs")	1.08	1.24	1.00

TABLE 2. Associations of SSS, Objective Social Status, and all Other Study Variables (Race/Ethnicity, Health Conditions and Medication use, Health Behaviors, and Health-Related Adiposity Measures) With hs-CRP (n = 13,236)

	(0) Bivariate	(1) SSS by Sex	(2) Objective SES	(3) Race/Ethnicity	(4) Illness/ Medication Use	(5) Health Behaviors	(6) Obesity
0. Subjective social status							
SSS	−0.072*** (−0.093 to −0.050)	−0.093*** (−0.115 to −0.070)	−0.067*** (−0.090 to −0.044)	−0.067*** (−0.090 to −0.044)	−0.060*** (−0.083 to −0.036)	−0.059*** (−0.082 to −0.036)	−0.055*** (−0.075 to −0.034)
1. SSS by sex							
Female	0.546*** (0.484 to 0.609)	0.313** (0.096 to 0.529)	0.307** (0.092 to 0.523)	0.307** (0.094 to 0.520)	0.231* (0.017 to 0.446)	0.199 (−0.015 to 0.412)	−0.180 (−0.475 to 0.116)
SSS by sex	0.080*** (0.069 to 0.092)	0.047* (0.006 to 0.087)	0.050* (0.010 to 0.090)	0.050* (0.010 to 0.089)	0.055** (0.015 to 0.095)	0.054** (0.016 to 0.093)	0.085*** (0.051 to 0.118)
2. Objective social status							
Participant educational attainment	−0.056*** (−0.074 to 0.037)		−0.044*** (−0.065 to −0.023)	−0.041*** (−0.062 to −0.020)	−0.041*** (−0.061 to −0.020)	−0.038*** (−0.059 to −0.018)	−0.018 (−0.036 to 0.000)
Participant-logged household income	−0.108*** (−0.148 to −0.068)		−0.013 (−0.057 to 0.032)	−0.002 (−0.049 to 0.044)	0.007 (−0.039 to 0.054)	0.011 (−0.036 to 0.058)	0.005 (−0.032 to 0.043)
Participant occupational prestige	0.001 (−0.002 to 0.002)		0.001 (−0.001 to 0.003)	0.001 (−0.001 to 0.003)	0.001 (−0.001 to 0.003)	0.001 (−0.001 to 0.003)	0.001 (−0.001 to 0.003)
Parental educational attainment	−0.106*** (−0.134 to −0.079)		−0.065*** (−0.094 to −0.036)	−0.055*** (−0.086 to −0.024)	−0.054*** (−0.084 to −0.024)	−0.047** (−0.076 to −0.017)	−0.017 (−0.040 to 0.007)
3. Race/Ethnicity							
Hispanic	0.210*** (0.108 to 0.312)			0.117* (0.011 to 0.223)	0.130* (0.031 to 0.228)	0.108* (0.014 to 0.203)	0.081* (0.005 to 0.156)
Black	0.175***			0.102	0.134*	0.105*	−0.004
	(0.078 to 0.271)			(−0.002 to 0.206)	(0.029 to 0.239)	(0.004 to 0.205)	(−0.090 to 0.082)
Asian	−0.528*** (−0.711 to −0.345)			−0.484*** (−0.666 to −0.302)	−0.463*** (−0.630 to −0.295)	−0.487*** (−0.648 to −0.326)	−0.295*** (−0.401 to −0.189)
Other	0.165 (−0.074 to 0.405)			0.130 (−0.096 to 0.356)	0.097 (−0.131 to 0.325)	0.094 (−0.134 to 0.322)	0.085 (−0.078 to 0.249)
4. Illness and medication use							
Subclinical	0.253*** (0.208 to 0.298)				0.178*** (0.132 to 0.224)	0.175*** (0.129 to 0.222)	0.179*** (0.137 to 0.220)
Infectious/Inflammatory illness	0.116*** (0.073 to 0.159)				0.028 (−0.018 to 0.074)	0.033 (−0.013 to 0.079)	0.013 (−0.026 to 0.052)

Other illness	0.256*** (0.211 to 0.301)	0.173*** (0.125 to 0.220)	0.165*** (0.117 to 0.212)	0.006 (−0.031 to 0.043)
Medication use	0.236*** (0.162 to 0.308)	0.114** (0.045 to 0.184)	0.120*** (0.052 to 0.189)	0.129*** (0.070 to 0.189)
5. Health behaviors				
Physical activity	−0.121*** (−0.150 to −0.093)		−0.078*** (−0.160 to −0.049)	−0.058*** (−0.082 to −0.033)
Alcohol use	−0.083*** (−0.101 to −0.065)		−0.032*** (−0.049 to −0.014)	−0.001 (−0.017 to 0.014)
Past smoking	−0.009 (−0.083 to 0.065)		0.048 (−0.038 to 0.135)	−0.066 (−0.140 to 0.009)
Current smoking	0.008 (−0.063 to 0.080)		0.086 (−0.002 to 0.175)	−0.015 (−0.096 to 0.066)
6. Obesity				
Body mass index	0.084*** (0.080 to 0.087)			0.131*** (0.109 to 0.153)
BMI by sex	0.028*** (0.026 to 0.030)			0.011*** (0.004 to 0.017)
BMI^2	0.001*** (0.001 to 0.001)			−0.001*** (−0.001 to −0.001)
Waist circumference	0.035*** (0.033 to 0.037)			0.012*** (0.008 to 0.016)

hs-CRP = high-sensitivity C-reactive protein; BMI = body mass index; SSS = subjective social status.

Data present regression coefficients and 95% confidence intervals (in parentheses).

* $p < .05$, ** $p < .01$, *** $p < .001$.

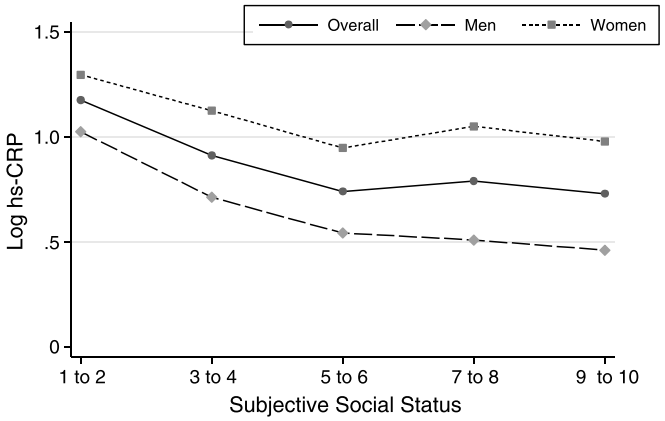

FIGURE 1. Weighted mean levels of log hs-CRP for the overall sample, men and women across levels of subjective social status. hs-CRP = high-sensitivity C-reactive protein.

coded pregnancy and use of oral contraceptives and/or deleting women who endorsed these variables, e) testing interactions between sex and oSES variables, f) testing interactions between sex and race, g) including additional health behaviors (e.g., insomnia), h) adjusting for psychological variables that could influence ratings of SSS (e.g., neuroticism and depressive symptoms), and i) testing models with BMI or waist circumference only. The SSS by sex interaction also did not further differ by race. Finally, we applied the Holm-Bonferroni method, which is a widely used method that is uniformly more powerful than Bonferroni corrections, to adjust p values to address the issue of multiple testing (46). After applying these corrections, the SSS by sex interaction remained significant at $p < .001$ in Model 6. The p value of a few coefficients in Model 6 changed to $p > .05$, including being of Hispanic ethnicity (see also Table S5 in Supplemental Digital Content 1, http://links.lww.com/PSYMED/A271).

Assessing the Size of the SRH Effect in Men

To gauge the effect size of the SSS-CRP association in the final model (i.e., Model 6) for men, we calculated standardized coefficients for SSS, oSES, and other common correlates of hs-CRP. The standardized coefficient for SSS in men's Model 6 was $\beta = -0.048$. β Values were 0.065 for medication use, 0.111 for subclinical disease, and 0.016 for inflammatory/infectious disease, respectively. Thus, effect sizes for SSS were similar in size or larger compared with prominent medical correlates of CRP. β Values were −0.052 for participant's education and −0.037 for parental education. Thus, the size of SSS–hs-CRP associations was comparable to that of participants' educational indicators of oSES.

DISCUSSION

Subjective perceptions of status contribute to the SES-health gradient from middle adulthood onward, even when objective measures of SES are taken into account (e.g., Refs. (7,10,11,47)). Social status can be in flux during key milestones of young adulthood, including the completion of postsecondary education and establishing oneself in a career and community (48). Indeed, when ranking themselves during this developmental period, young adults likely transition from primarily drawing on their (inherited) parents' social position to drawing on their own (ascribed) social position. The present analyses using the Add Health revealed that SSS–hs-CRP associations are detectable during young adulthood, especially in men, even with stringent controls for oSES and other measures of health behaviors and health. Thus, young adult men's lived daily experiences of social status have unique associations with a marker of risk for cardiovascular health problems.

Why is "social status syndrome" (49)—that is, the manifestation of SSS in health—detectable in young adult men but not women with respect to hs-CRP? Young adult men's identities may be centered around socioeconomic hierarchies, including workplaces, as they face stereotypical societal pressures involving the establishment of careers and primary breadwinner roles. Despite changing gender roles in today's society, social status is typically still more key for successfully securing a mate for US men than women (29,30). Not surprisingly, social rankings in men are also associated with a host of other biomarkers linked to health and inflammation, including testosterone. This has not consistently been found to be the case in women (31).

In contrast, at least some young adult women may fluctuate into and out of educational and workplace settings during their childbearing years and thus exhibit greater variability in terms of what information they draw on when ranking themselves in social hierarchies. They may, for example, draw more on their parents' than their own achievements in ranking themselves (which would explain the SSS effect being accounted for with the inclusion of oSES indicators in women). Furthermore, they may draw on their partner's ranking (e.g., Ref. (50)). In addition, social hierarchies beyond socioeconomic position may play an important role in women's health. Women are known to draw on "tend and befriend" strategies to ensure their own and

their offsprings' survival, perhaps especially during their reproductive years (51). Thus, rankings in perceived social support, family relationship qualities, and friendship networks could play a greater role in young women's health. These types of hierarchies may be not be fully captured by the SSS ladder.

Young adult men are also exposed to fewer proinflammatory influences compared with women—many of whom are exposed to oral contraceptives and hormonal and metabolic changes associated with pregnancy, childbirth, and breast-feeding. Thus, the SSS-CRP signal may be easier to detect in young adult men than women. We could not control for all of these potentially proinflammatory influences on young women; however, patterns of results remained similar when we reran analyses excluding pregnant women, women using birth control, and women with very young children (who may have been nursing).

Interestingly, select studies of older adults reported reverse patterns of sex differences in SSS-CRP associations. For example, Demakakos and colleagues (10) reported that SSS-CRP associations were present in women but not in men in fully adjusted models. It is possible that older women become more attuned to their own subjective socioeconomic standing. It is also possible that, with aging, competing proinflammatory influences decrease in women, making it easier to detect SSS-CRP associations, whereas proinflammatory influences in men increase as they face early manifestations of chronic disease.

What mechanisms could explain the unique contributions that SSS makes to SES "getting under the skin," especially in young men? Because SSS is a global summary rating of social standing that likely subsumes economic and social components, a variety of mechanisms are possible (e.g., Ref. (13)). In addition to actual low access to resources and privileges, men with low SSS could have a low sense of personal control and mastery, which, in turn, has been linked with poor health. They could also perceive themselves as targets of interpersonal rejection or bullying, which also has been linked to increased inflammatory levels (52). Finally, men with low SSS could perceive more stressors overall (8) and/or have poorer coping strategies for dealing with them.

Indeed, work from smaller laboratory-based studies suggests that low SSS could represent a "double-hit" for health. SSS marks not only relatively chronic perceptions of low rank (and the possible health implications of such chronicity) but also more intense physiological responses to acute stressors (53), including larger short-term increases in interleukin (IL)-6 to acute stressful social situations (8,53–56). Greater, repeated, and prolonged reactivity in response to perceived social threats could, in turn, contribute to long-term dysregulated immune responses captured by measures of systemic inflammation (57). Sensitivity analyses controlled for depressive symptoms and neuroticism and findings remained unchanged; thus, these two constructs are unlikely to be key mechanisms in explaining the unique associations in our final models.

Finally, our sensitivity analyses showed no evidence of SSS by race or SSS by race by sex interactions in the prediction of hs-CRP. Some studies of oSES–inflammatory marker associations found no evidence of associations or weaker associations in their African American subsample (1,58–60). Additional research should illuminate why links between SSS and health indicators are detected in some but not in other studies of historically disadvantaged groups.

Limitations

First, this study was cross sectional, with only one assessment of hs-CRP. Therefore, we could not test whether decreases in SSS predicted increases in systemic inflammation ("causation" hypothesis) and/or vice versa ("selection" hypothesis). Second, the Add Health study currently has data on one inflammatory marker only. Associations between SSS with other markers of immune function, including IL-6, IL-1, tumor necrosis factor α, and white blood cell counts would be of high interest. Third, key measures of SES were self-reported. Add Health also does not verify educational attainment or income.

Implications

Despite these limitations, our study suggests that SSS has real-life ramifications for men's health above and beyond "hard" objective markers of SES (e.g., Ref. (3)). Viewing oneself as lower in status seems to be a chronic stressor that also compounds stress reactivity and poor coping in response to acute stressors (7,8). SSS is likely more easily changed compared with indicators of oSES such as income and education. For example, using cognitive behavioral strategies and/or mindfulness-based stress reduction techniques, people could change their subjective perceptions of social rank and social threat, alter their physiological reactivity to such threats, and also increase positive coping strategies (e.g., Ref. (61)). These strategies could, in turn, improve health outcomes in the long run (62).

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